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SOLVING POLLUTION PROBLEMS THROUGH COOPERATION

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SOLVING POLLUTION PROBLEMS THROUGH COOPERATION

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Stream pollution problems and ways and means of solving them have been the concern of engineers, administrators, and students of Government for many years. The problems have become magnified along with the growth of our municipalities and the development and re-location of our industries. The rapid development of new industrial processes, the constantly changing methods and materials have also added to the complexity of the over-all problem. Thus, in attempting to properly appraise these problems, to seek their solution, and to make plans for future development, the Sanitary Engineer must use all of the tools which are available to him.

As he begins his analysis of the task before him, he will realize that for the most part he is dealing with problems which demand a thorough understanding not only of scientific knowledge but also of the social and economic factors involved. This is particularly true when it is recognized that the solution of these problems may have a direct influence on the economic and social life of a community or a state. The engineer needs an appreciation of the total program. In this regard a statement made by Thorndike Saville[2] more than twenty years ago takes on added meaning and remains the important question to be considered in solving stream pollution problems. Mr. Saville said: "The complexity of the problem of water pollution is well indicated by the fact that with all the advance in the sciences related to industry and Government, with the notable increase in stream pollution everywhere consequent upon industrial development and growth of urban populations, no country had yet worked out any scheme satisfactorily reconciling the conflicting interests of public water supply versus waste disposal; of industrial interests versus those of the sportsman; of public welfare as opposed to private or corporate gain; or in short the true conservation of water resources by maximum judicious use for the greatest public benefit."

Thus accepting the fact that the problem is complex and that there is no easy solution, the engineer's first move is to align his resources and select those tools which will enable him to attain his goal more adequately and satisfactorily.

The scientific tools which he will need in the solution of his problems are:

1. The sciences of biology, chemistry, bacteriology, and limnology.
2. The social sciences, including the science of economics and political science.
3. Legal science.

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1. Director, San. Eng. Div., North Carolina State Board of Health, Raleigh, N. C.
2. Thorndike Saville, "Administrative Control of Water Pollution" Interim Publication of American Institute of Chemical Engineers (Nov. 3, 1931).

The engineer must have the scientific knowledge gained through the study of biology, chemistry, and bacteriology, together with his fundamental engineering training, if he is to approach the solution of the technical aspects of stream pollution problems.

The social sciences cannot be overlooked in developing pollution abatement programs, any more than can the basic sciences mentioned above.

Serious consideration of political science as another tool becomes mandatory, in order to appreciate the historical development of stream sanitation programs, and to appraise the effects which politics have on the establishment of policies, and consequently, on the final execution of the program. And, in considering the state-wide or nation-wide effects of proper water conservation and stream use, it is not difficult to appreciate the important part which the science and philosophy of government must play in an undertaking as broad in its conception as is the problem of stream pollution abatement.

The sanitary engineer, through his education, experience, and practical training, has learned to apply the basic or fundamental sciences in considering the technical aspects of pollution problems. But all too often he has failed to distinguish himself in the astute application of the economic, legal, political, and social sciences. The failure to properly use these sciences has not helped to develop public understanding or to create a positive desire which would demand that the problem be solved. It cannot be said, therefore, that a solution has been found to any particular stream pollution problem where the parties with conflicting interests have not been satisfied that the best interests of government and the individual have been dealt with fairly.

The application of technical "know how" to the study of specific problems, such as the reduction of wastes within plants through improvement in manufacturing processes, the planning of treatment or remedial works, and the design and operation of sanitary facilities, will be successful in their application only when consideration is also given to the human factors involved. Technical ability alone is not enough when searching for the solution to pollution problems, all of which affect human beings, whether the problem be with municipalities or industries.

Municipalities are composed of and controlled by people, most of whom have little or no appreciation of the exact sciences which control engineering design, construction and operation.

Industries are not just names in a directory, or a listing in Dun and Bradstreet, but are creations of man brought about by ingenuity, engineering, and the successful application of the laws of finance and business. If an industry is to prosper, its expenses must be kept below income. Management must also maintain a favorable position with competitors. Thus, the sanitary engineer is dealing with human beings who plan, design, and operate facilities which produce materials and products for the use of mankind, and thus exert their influence on the economic, social and political life of the state and nation.

The engineer cannot, therefore, fail to recognize the human values as a most important part of his problem and co-ordinate his technical findings and conclusions with the social factors in arriving at his solution.

Co-operation becomes particularly significant and must be considered as a primary tool of the engineer as he works toward his objectives in the program of proper stream use and sensible stream sanitation. The word

"co-operation" as used here does not mean simply the working together of two or more people, but more the joint action of individuals, groups, agencies, businesses, states, and the government applying their particular talents and resources in a joint undertaking for the common good of all concerned.

In applying the tool of co-operation to the problem the proper interpretation of scientific facts should be considered of paramount importance. Technical men, when discussing a technical problem among themselves, quite often disagree as to the end results to be expected. This may be particularly true if the subject happens to be industrial waste treatment, stream pollution, proper stream use, or stream abuse. Is it little wonder, then, that dissolved oxygen means nothing to the person who sees dead fish in a stream or along its banks? Scientific turbidity determinations are of little help in discussing the conditions of a stream with a person who knows the stream was once crystal clear but now is defiled and dirty. The particular laboratory method used in the determination of B.O.D., although most important, must not be allowed to take precedence over the proper evaluation of B.O.D. loading and the effect this loading may exert on the economic values of stream sanitation.

Furthermore, in the interpretation of scientific facts there must be a mutual understanding and agreement between the engineer and other technical workers - the chemist, the bacteriologist, the biologist - if there is to be a united and co-operative approach and an honest desire to solve the problems at hand.

Administrators, management, and regulatory authorities must be guided in their final decisions and actions by the findings obtained by the scientific workers, after proper consideration has been given to these findings and to all of the other factors involved. It becomes imperative, therefore, that proper interpretation of scientific data be made to all concerned.

The interpretation of scientific data becomes a phase of the next important step which is education of the people. They must be informed of the stream condition as it exists in terms and in a manner which they will understand. But, what is more important, they must be acquainted with the aims, accomplishments and benefits to be derived from a sensible stream sanitation program.

This, of course, means proper publicity and the wise use of propaganda. Some may consider this a duty of regulatory bodies only, but since the program is a joint undertaking being pursued on a co-operative basis, all parties have a stake in this activity. Who is better qualified to inform the public than the engineer closest to the problem? And, if he considers the social aspects, as well as the scientific, in arriving at his solution, he is in a position to help mold public opinion and secure more co-operation in the over-all objectives. As Nikirk[3] has expressed it: "This leads us to the inescapable conclusion that the engineer must give some attention to influencing public beliefs and philosophies. This means propaganda, a word which bears a stigma due to the perversion of its use. Perhaps a new word must be coined, but the fact remains that in a realistic world, propaganda is ever present. If those most vitally interested do not attempt to direct it, they should not complain of its adverse results in the hands of others."

In the co-operative approach to the question of education and publicity, nothing takes on more importance than the exchange of scientific data derived from research and study. Such an exchange, not only of factual data but of ideas and interpretations, can only be classed as intelligent co-operation. It enables those confronted with the same problem to gain a broader concept of

3. F. A. Nikirk, M. ASCE. "Co-operation for Stability" Civil Engineering, May, 1942. p. 237-238.

the problem, and hence, adds materially to the weighing and evaluation of all factors when final decisions are made. If the same cooperative exchange of ideas and philosophies has prevailed in the development of proper state legislation, then the corrective steps in the solution of the problem, for the most part, remain of technical nature. This being the case, the parties involved can gather more satisfactorily around the table and together find a workable answer.

The procedure and philosophy discussed above have been followed in North Carolina approaching the State's stream pollution problem. Although the program is relatively young, it has been highlighted by co-operation from its inception and the ground work has been laid for further expansion along the lines enumerated.

The North Carolina State Board of Health expanded its Sanitary Engineering Program in 19204, and a comprehensive program was inaugurated to provide adequate protection and purification of public water supplies. It was recognized at that time that the problems of water supply and waste disposal went hand in hand, and that one phase could not be developed adequately without attention being given to the other. As the water supply program was developed to meet the growing needs of municipalities and industrial expansion, it was apparent to the sanitary engineers that more efficient sewage treatment plants would be needed to protect the streams which were the source of many of our public water supplies. Although a number of sewage treatment plants had been built, they were designed primarily for domestic sewage with very little consideration being given to industrial wastes which were discharged to these plants. Since no provision had been made for the treatment of industrial wastes in these plants, they served to point up the critical need for the study of industrial wastes and the collection of scientific data. Such studies were begun by the State Board of Health, in co-operation with municipalities and industries, and much was learned that later could be applied to plant design.

Several of the State's largest industries, notably pulp and paper and textile, co-operated with these studies.

At the time the State Board of Health was concentrating on sewage and waste studies for public health purposes, the State Department of Conservation and Development became disturbed over the destruction of fish life and the effects of pollution on other activities with which that Department was concerned. Since the studies being made by the Board of Health were developing information which was identical with the information needed by the Department of Conservation and Development, a co-operative project was inaugurated between these two State agencies. This voluntary unit was known as the State Stream Sanitation and Conservation Committee. Each department furnished personnel and their activities were co-ordinated in such a manner as to prevent the overlapping of duties and responsibilities. The sanitary engineers with the State Board of Health made the stream studies and sewage and industrial waste investigations. The engineers of the Department of Conservation and Development furnished stream flow records and did the stream gauging, preparation of maps, etc. There was a free exchange of information between the two departments, and each received from the other assistance and information needed to carry out its individual program.

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4. J. M. Jarrett, "History of the Development of Water Pollution Control in North Carolina," Proceedings of First Southern Municipal and Industrial Waste Conference, Department of Engineering Research Bulletin No. 55, N. C. State College, p. 13-23.

This co-operative venture without any legislative authority was the forerunner of the present State Stream Sanitation Committee. The co-operative approach and demonstration of the ability of engineers in different fields of activity to work together for a common goal helped lay the ground work on which the philosophy and later stream sanitation program of North Carolina has been built. It not only demonstrated that engineers within different state agencies could work together, but also that representatives from industry and municipalities could join hands, when there was a real understanding of the problem, coupled with a mutual desire to do something about it. It is significant to note that those industries and municipalities which co-operated in the first voluntary venture are today taking the lead in the present program of pollution abatement and proper stream use.

Even though the original voluntary program could be termed successful, it pointed out the fact that sensible, equitable, and reasonable legislation would be needed to guide the state agencies concerned and give some degree of protection to the municipalities and industries. Consequently, efforts were made to secure legislation on several occasions, but due to interruptions in the co-operative program brought about by the depression and later by World War II, educational work had not been carried forward to inform properly those involved. Therefore, it was not until 1945 that the North Carolina General Assembly recognized the need for an orderly legal approach to the problem.

In that year the State Stream Sanitation and Conservation Committee was revived and was given legal authority to study the conditions of the streams in the State and to report back to the General Assembly their findings and recommendations. This committee was composed of sixteen members selected from the pulp and paper industry, textile industry, municipalities, agriculture, the tanning industry, the clay industry, the State Board of Health, the State Department of Conservation and Development, the School of Public Health of the University of North Carolina, and the State Planning Boa-d.

This committee, composed of leaders in each particular field mentioned, had a real appreciation of the need for the conservation of the state's water resources. Because of this, and because of the variety of interests represented, it was possible to chart a course for the future development of a sound water conservation and improvement program. The group was concerned not only with developing a policy, but also it worked toward unanimity of thought regarding legislation which would be equitable to all and which would recognize the many legitimate uses which the water resources must serve.

Following a study and survey made by R. E. Steimke[5] for the committee, legislation was introduced and finally adopted in 1951. Legislative authority to control the pollution of the streams through their classification as to best usage is not entirely in keeping with the recommendations of the committee, but the pattern has been set and is in accord with the thinking of the governmental leaders of the state. This emphasizes the point made earlier that through co-operation and full appreciation of all the sciences and factors involved, personal opinions must eventually be reconciled with group decisions. If one group is allowed to dominate this thinking contrary to the personal beliefs of the engineer, then he has failed because he did not properly use all of the tools at his disposal.

5. Robert E. Steimke, "The Extent of Stream Pollution in North Carolina," Department of Engineering Research Bulletin No. 34, N. C. State College.

In developing a policy to be followed and the type of legislation desired, it was the consensus of the committee that the solution of the problem could best be attained at the state level. This did not mean that the state desired to "go it alone," but to the contrary, sought and welcomed the co-operation of the federal government and all other interested agencies. One of the first projects in North Carolina in which an entire river was studied was carried out co-operatively with the Tennessee Valley Authority. The Public Health Service has co-operated both financially and in supplying technical information of aid to the federal government and the state in their approach to mutual problems. The U. S. Geological Survey has been particularly helpful, and this agency is presently working very closely with the Stream Sanitation Committee in supplying flow data, special gauging stations and an analysis of flow records.

Co-operation with adjoining states has been of distinct value in demonstrating that contiguous states may better handle their interstate pollution problems themselves, rather than be faced with the possibility of the federal government usurping these responsibilities and rights. These inter-state problems have not been solved, but the co-operative approach, particularly the understanding of the needs of each state, should eventually bring about satisfactory solutions. The interstate problems of pollution control must be recognized by the states involved, and there must be joint action to conserve or protect natural resources of interstate character. If this is not done, if the resource affecting the national life and economy is depleted or made useless, then it may be expected that the federal government will intervene. Engineers acting as consultants to municipalities and industries should give attention to this fact in advising their clients, when arriving at the solution to their stream pollution problems, where interstate relationships are involved. The problem is only half solved if it protects one state's uses, but ignores another's. The need for this co-operation between states is recognized in the North Carolina law.

Co-operation with industries in North Carolina has and is continuing to develop working relationships in waste studies, the exchange of scientific data, and in promoting a better understanding of the technical, social, and economic factors involved in waste treatment or disposal. Special projects to determine the peculiarities of specific industrial wastes, the possibility of reclaiming or pre-treating the waste, their effect on the biological sewage treatment processes, and their relative effect on the stream to which they must eventually be discharged are being undertaken. Industry in such cases can contribute materially to the solution of the over-all problem through such studies. As the engineers, municipalities, and regulatory agencies exchange this information, they become better informed of the problems facing each group and of the technical and financial limits to which each must go.

This co-operation is being extended to the engineering research units of educational institutions. Work done by H. G. Baity[6] and others in past years, working with the Textile Foundation, stands out as an excellent example of this phase of the program. In developing the state's present legislation, cognizance was taken of the use of this tool, and special provision was made by writing into the law methods which would insure such co-operation. The sanitary engineer too often has not taken advantage of the research facilities

6. H. G. Baity, John C. Geyer, William A. Perry. "Textile Waste Treatment and Recovery," Textile Foundation Inc., Washington, D. C., 1936.

at educational institutions, and, because of the lack of such facilities in his own organization, has attempted to solve complex problems without having complete information on which to base his decisions. The U. S. Public Health Service through its research units, educational institutions, and industrial organizations can contribute materially to the scientific knowledge needed in solving industrial waste problems. The dearth of specific information relating to certain industrial wastes, such as the possible toxic effect of many materials on human, fish, and biological life, is a field open to research units and one which urgently needs to be expanded.

In the state government, there is hardly an agency or unit which does not have a direct or indirect interest in the pollution problem, since it reaches into and affects all elements of society. It is vital, therefore, that close co-operation be maintained among these various state agencies by the engineer in order that maximum benefits with the least amount of confusion and duplication of effort will be derived. Stream Sanitation legislation in this state specifically recognizes the need for co-operation and contains the following statement: "All state departments shall advise with and co-operate with the committee on matters of mutual interest."

Without co-operation from the municipalities and their consulting engineers progress cannot be made toward solving pollution problems. Although much emphasis is placed on industrial waste treatment and disposal, domestic sewage remains perhaps the chief offender in the over-all problem. The problems of municipalities are also as perplexing in many respects as are those of industry. They are often more difficult to solve because of the political factors which must be considered, emphasizing again the vital part which political science must play in these matters. The engineer must help bring about an understanding of the problem as a whole and must appreciate the limited financial resources of the smaller governmental units. If these problems are to be solved, the tools of co-operation and political science must be used constantly and quite freely. In North Carolina, the League of Municipalities has worked closely with the regulatory agency and has not only supported legislation, but has also been active in promoting certain remedial works. This attitude on the part of an agency, whose primary function is to give legal advice and assistance to its municipal members, did not just happen. It was shown through co-operation and education that the results to be derived from a sensible stream-use policy would work to the benefit of the municipalities. They must have water supplies and must dispose of their wastes; they also want industry with its payrolls and taxes; they want industry's economic benefits, but at the same time they realize that without water -- usable water -- neither they nor industry can survive and prosper. They must co-operate or stagnate. The engineer, and particularly the sanitary engineer, can do much to prevent this stagnation.

Another point worthy of mention, affecting the municipalities and industries, has been the development of training schools for sewage and industrial waste plant operators, which is a direct result of the co-operative efforts of state agencies, state and private educational institutions, industry, municipalities, and the Water and Sewage Works Association. A serious weakness in this phase of the program is the failure of the engineering profession to help create a desire on the part of the high school and undergraduate student to seek training in this field. The future will demand competent, technically trained people to assure the proper design and operation of sewage and waste treatment facilities.

Possibly the most difficult phase of the co-operative approach is that of dealing with unofficial groups and associations. Here, the engineer will be called upon to exert more effort in a field which is all too often not fully appreciated or used--the field of public relations and public contact. There are many such groups, all of whom have considerable influence in local political matters, and all of whom have a great interest in stream pollution control.

These groups must be educated to the aims, complexities, and benefits of the total program. They must not be allowed to fly off on a tangent. And, at the same time, their interest and enthusiasm must be kept alive and directed in the right channels. This will require the intelligent dissemination of information--scientific and economic--if these groups are to aid materially in the program of water conservation and its legitimate use. Such groups in North Carolina have aided materially in securing legislation, in prodding lethargic city councils, and also in keeping the regulatory agency alert to the needs and desires of the citizens of the state.

With this background of philosophy, with a law that is not perfect but one that recognizes the importance of the topics discussed, with a policy and program based on the conservation of the water resources for the benefit of all--what has been accomplished toward the solution of the stream pollution problem using co-operation as a primary tool? The following illustrates the question:

At Marion, North Carolina an industrial waste and domestic sewage treatment plant has been placed in operation as reported by Grey.[7] This plant was designed to replace old and inadequate facilities and was financed jointly by the town and the industry involved. The preliminary surveys of the town's needs were made by the engineers of the State Board of Health at the request of the city manager and in co-operation with the city's consulting engineering firm. The personnel, employed through funds made available by the U. S. Public Health Service in its operation of Public Law 845, made studies of the industrial wastes since the effluent from the proposed plant was to be discharged to an interstate stream. Although the present state law had not been passed by the General Assembly when the survey started, the use of the stream to receive the effluent, the industry's effect on the economic life of this community, the possible expansion of industry in the community, and the social aspects of the problem, although not well defined, were given consideration. The co-operation between state agency, municipality, and industry was all that could be desired. Information as to quantities of waste, type of industrial processes, and the ability to treat the wastes separately, or combined with domestic sewage, was determined. Recommendations were made based on these findings. The plant and dual collecting sewers cost approximately $400,000.00, not including legal and engineering fees. The cost was shared by the textile mill contributing waste to the system. This mill has also agreed to share in the operational costs attributable to treatment of their industrial wastes.

The engineers of the State Board of Health assisted in placing the plant in operation. Data collected on various methods of treatment which can be applied will be available in the future when considering similar type problems.

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7. John C. Grey, "Sewage - Textile Waste Plant Has Six Treatment Methods," Wastes Engineering, April, 1953. p. 198.

Another very similar case is Salisbury, North Carolina. Salisbury is a city of 20,000 population and has a number of industires within the city, including textile mills. When it became evident that the city would have to improve and enlarge its sewage treatment facilities in order to correct its pollution problem, a preliminary investigation indicated that one large textile mill was contributing a considerable portion of the pollution load. It appeared that the logical approach to the solution of the problem was for the city and the mill involved to get together and discuss their joint responsibilities, or determine the responsibility of each. Thus, in 1951 a meeting was called to map out a method of research and field investigations concerning the treatment of dye wastes from the mill and the domestic wastes from the city of Salisbury. Representatives of the city, the mill, the consulting engineer, and North Carolina State College were present. The viewpoints of the State Stream Sanitation Committee were also expressed at that meeting. Out of the meeting came a research plan which was agreed upon by all parties concerned. The research was carried on by one of the engineering professors, Nelson L. Nemerow[8] of State College, in co-operation with the State Board of Health and the State Stream Sanitation Committee. After the research work had been completed, representatives of all interested parties again got together and determined the improvements needed, the methods of treatment to be applied, and the distribution of responsibilities and cost. It was estimated that improvement to the existing facilities and the construction of new facilities would cost approximately $611,000.00, of which approximately $490,000.00 would be borne by the city and $121,000.00 by the mill involved. In this particular case two interested agencies of the state, the industry involved, the city, the city's consulting engineer, and a research engineer from one of the state's educational institutions worked together closely to find the answer to this particular stream pollution problem.

Another phase of co-operation has taken place between municipalities and industries where joint industrial waste and sewage disposal problems were involved. Such an example is the City of Charlotte where the city working with the consulting engineers and industry has adopted a sewer use ordinance which permitted a realistic co-operative approach to the administration of a joint sewage and waste disposal problem.

The above-mentioned examples are actual cases where co-operation has entered into the investigations and design of treatment facilities to serve both industry and municipality.

In addition to the design and construction of remedial works, there have been other outstanding examples of co-operation between the federal government and adjoining states.

Since the inauguration of the program of stream study and classification by river basins, excellent working relationships have existed between the states of Tennessee, Virginia, and North Carolina and the U. S. Public Health Service. One study carried on during the summer of 1953 involved the Roanoke River Basin. The Roanoke River winds in and out of Virginia and North Carolina before finally reaching Albermarle Sound on the eastern North Carolina coast. A number of municipalities in both Virginia and North Carolina secure their waters from the Roanoke River Basin and discharge their wastes to these streams. There are, likewise, a number of industries

8. Nelson L. Nemerow, "Textile Dye Waste Treatment," Department of Engineering Research Bulletin No. 55, N. C. State College. p. 165-170.

located in both states discharging their wastes to the streams. Furthermore, because of the construction of power dams by private utilities and by the federal government, the Roanoke River Basin becomes a typical interstate problem, combining all of the interests: federal, state, industrial, and municipal.

At the request of the states, the U. S. Public Health Service has assisted in actual survey work and has acted as a liaison between the states, the Federal Power Commission and the Corp of Engineers. The states of Virginia and North Carolina have carried on joint surveys and studies within the river basin all of which point to joint consideration and action in connection with the final solution of the pollution problems in this basin. Thus from the above, it may be seen that co-operation is a reality in North Carolina and when given proper consideration in the solution of stream pollution problems becomes one of the most important tools available for the use of the engineer.

CONCLUSIONS

As pointed out in this paper, there are many tools available to the sanitary engineer in his consideration of stream pollution problems; many of the tools with which he must work are the tools of the social sciences as well as technical sciences. Each of them is important, and each plays a vital part in the solution of the over-all task.

An attempt has been made to show that of these various tools none is more important than the tool of co-operation, when it is applied by all parties concerned. Examples are cited to indicate that this approach to the solution of these perplexing problems has been successful in North Carolina. In the development of a stream sanitation program or in the solution of stream pollution problems, the plan of approach referred to above is worthy of attention by the sanitary engineer concerned.